

*REMARKS/ARGUMENTS*

The following remarks are responsive to the points raised by the Office Action dated January 27, 2009. In view of the following remarks, reconsideration is respectfully requested.

*The Pending Claims*

Claims 1-46 and 49 are pending.

*Allowable Subject Matter*

The Applicants are pleased to note that the Office Action indicates that claims 15, 24, 25, 31, 39, 42, 43, and 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

*The Office Action*

Claims 1-3, 5-9, 12, 13, 18, 19, 22, 23, 29, 33, 41, and 46 were rejected under 35 U.S.C. § 102 as anticipated by U.S. Patent No. 6,030,520 to Dziewinski et al. (hereinafter, "Dziewinski").

Claims 29, 30, and 32 were rejected under § 102 as anticipated by U.S. Patent No. 5,951,869 to Heskett (hereinafter, "Heskett").

Claims 4, 11, 20-21, 26, 28, 34, 38, 44 and 49 were rejected under 35 U.S.C. § 103 as unpatentable over Dziewinski as applied to claims 1 and 22.

Claim 10 was rejected under § 103 as unpatentable over Dziewinski as applied to claim 9 and further in view of U.S. Patent No. 4,283,290 to Davies (hereinafter, "Davies").

Claims 14 and 16-17 were rejected under § 103 as unpatentable over Dziewinski as applied to claim 1 and further in view of U.S. Patent No. 5,093,099 to Haishi et al. (hereinafter, "Haishi").

Claims 35 and 39 were rejected under § 103 as unpatentable over Dziewinski as applied to claim 33 and further in view of Heskett.

Claims 36 and 37 were rejected under § 103 as unpatentable over Dziewinski in further view of Heskett as applied to claim 35 and further in view of U.S. Patent Application Publication No. 2005/0183964 to Roberts (hereinafter, "Roberts").

Each of these rejections is separately and respectfully traversed.

Claim 1 is directed to a method for chemically treating a liquid medium loaded with nitrates. The method comprises contacting zinc with the liquid medium, wherein the liquid medium has a pH less than 4. Advantageously, the claimed method effectively reduces nitrates into nitrites and reduces nitrites into non-pollutant species in no more than a single step that exclusively requires the addition of a single, unique compound (i.e., zinc) to the liquid medium to be treated.

The claimed method comprises contacting a liquid medium loaded with nitrates and having a pH less than 4 with zinc. The claimed method avoids a pH above 4 so that the liquid medium is strongly acidic. At a pH above 4, the reaction that takes place is different from the reaction that takes place at a pH below 4. Above a pH of 4, the nitrate reduction slows or stops (specification, page 17, line 23 to page 18, line 26; Figures 15-22).

The anticipation rejection of independent claim 1 cannot be maintained. Dziewinski discloses a method in which aqueous waste streams containing nitrates are first contacted with a metal such as cadmium or zinc. A second metal "more noble" than the primary metal reagent may be used to catalyze the reduction reaction between the nitrates in the aqueous waste stream and the primary metal. These second catalyst metals include copper, silver, mercury, palladium, platinum and alloys or mixtures thereof (col. 3, lines 5-6 and 30-37). The nitrates are converted to nitrites with the addition of these two metals. The method of Dziewinski further requires a second step of contacting the nitrite solution with an amide reagent to reduce the nitrites to nitrogen and carbon dioxide or acid anions (col. 4, lines 8-14).

Therefore, Dziewinski is distinguishable from the claimed method in that it discloses the addition of a second metal and an amide reagent, which are not included in the claimed

method. Moreover, Dziewinski converts the nitrates to non-pollutant species in two steps, in contrast to the claimed method, which converts the nitrates to non-pollutant species in a single step. The claimed method, therefore, advantageously substantially reduces the time and costs involved in treating the liquid medium. Accordingly, the anticipation reaction cannot be maintained.

Moreover, the Applicants assert that Dziewinski fails to disclose the claimed pH of the liquid medium, which is less than 4. As stated in MPEP § 2131.03(II), if the claims are directed to a narrow range, and the reference teaches a broad range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims. In the case at hand, the teachings of Dziewinski with respect to pH are too imprecise and contradictory to be considered to have "sufficient specificity" to constitute anticipation of the claims.

Dziewinski discloses that the pH can range from about 0 to about 8 depending on the concentration of the nitrate at the start of the process (col. 4, lines 46-47). However, Dziewinski also discloses that the pH of both the nitrate to nitrite reaction and the nitrite to nitrogen reaction is adjusted as necessary to obtain a *weakly acidic* reaction environment, and that the pH gets *less acidic* as the reaction goes forward (col. 4, lines 43-51). The Applicants maintain that these teachings imply that the pH is between approximately 5 and 7, which is a pH range avoided by the claimed method. Dziewinski's disclosure of a pH from about 0 to about 8 appears to contradict the indication of a "*weakly acidic reaction environment*" since the range of pH 0-8 includes, in addition to the range corresponding to weakly acidic reaction, a first pH range corresponding to strongly acidic ( $\text{pH} < 4$ ) and a second pH range corresponding to weakly basic ( $7 < \text{pH} < 8$ ). In addition, Dziewinski also indicates a specific pH range of 1 to 6 for the specific conditions in which cadmium is used as the first metal, copper as the second metal, and urea as the amide (col. 4, lines 49-51).

In view of these contradictory teachings, it cannot be said that the claimed range is disclosed with "sufficient specificity" to constitute an anticipation of the claims. The most that the skilled person could take from the teachings of Dziewinski is that among the metals proposed, cadmium provides a pH of 1.7 (Dziewinski Example 1), or that the pH can vary during the reaction from small values at the very beginning of the method to reaching high pH values as the reaction goes forward until the end of the reaction. In any case, Dziewinski

does not disclose the use of zinc while keeping the liquid medium at a pH lower than 4, as claimed. In fact, no particular pH value is defined for the use of zinc and the only indications of pH values (weakly acidic and comprised between 0 and 8) contradict one another. Thus, the teachings of Dziewinski with respect to pH are too imprecise and contradictory to be considered to have "sufficient specificity" to constitute anticipation of the claims. Accordingly, the anticipation rejection cannot be maintained.

As evidence that Dziewinski fails to disclose the claimed pH with "sufficient specificity" to constitute anticipation of the claims, the Applicants submit herewith a copy of the prosecution history of the European counterpart to Dziewinski, EP Application No. 98 915 297 (hereinafter, "EP '297"). During examination of EP '297, the European Patent Office (EPO) stated that the feature indicating that the pH of the liquid medium is maintained "*at less than 5*" which was introduced into claim 1 during prosecution (see Exhibit A, submitted herewith), was not contained in the text as filed and therefore did not meet the requirements of Article 123(2) EPC because it was not clear from the description that the pH limit was exactly 5: "*from the description (of Dziewinski), it is neither evident where this limit value of pH 5 is to be found nor from where it can be deduced*" (Exhibit B, top of the page 2, submitted herewith). This feature was cancelled from claim 1 and the granted patent does not refer to a pH range at all (Exhibit C, submitted herewith).

Accordingly, the prosecution history of the European counterpart of Dziewinski (EP '297), evidences that Dziewinski does not describe a method of treating a liquid medium loaded with nitrates, comprising contacting zinc with the liquid medium, wherein the liquid medium has a pH less than 4. Accordingly, the anticipation rejection of claim 1 cannot be maintained.

Independent claim 29 is directed to a device for chemically treating a liquid medium loaded with nitrates and with a pH less than 4 comprising at least one liquid nitrate reduction enclosure, which comprises a liquid inlet, at least one zinc layer, a means for the circulation of the liquid medium through the zinc layer, and a liquid medium outlet of the enclosure.

Claim 29 recites that the liquid medium has a pH of less than 4. Accordingly, the anticipation rejection of claim 29 based on Dziewinski cannot be maintained for the same reasons set forth for claim 1.

The anticipation rejection of claim 29 based on Heskett cannot be maintained. The passage cited by the Office Action, column 4, lines 21-30, merely discloses adjusting the pH. Accordingly, the anticipation rejection cannot be maintained.

Since independent claims 1 and 29 are allowable for the reasons set forth above, the dependent claims are also allowable because they depend from and include the limitations of the allowable independent claims.

Claim 32 is also patentable, not only because it depends from and includes the limitations of patentable claim 29, but also because it defines limitations not taught by the cited reference, Heskett. Claim 29 recites that the zinc layer has a height less than 10 cm. The Office Action cites column 15, line 44 as disclosing zinc with a height less than 10 cm. However, Heskett only discloses that the quartz wool is 0.5 inches thick, and discloses that brass alloy filings containing about 50 weight percent copper and about 50 weight percent zinc were placed inside a tube having a length of 20 inches. Accordingly, Heskett does not disclose a zinc layer having a height less than 10 cm, as claimed in claim 32.

Claims 1 and 29 are patentable for the reasons set forth above. Davies teaches the recovery of dissolved species from an aqueous solution, Haishi discloses particles of zinc oxide, and Roberts discloses an electrolytic purification system. The teachings of Davies, Haishi, and Roberts are far removed from the reduction of nitrates. Accordingly, the combinations also fail to render the present claims obvious.

*Conclusion*

Applicants respectfully submit that the patent application is in condition for allowance. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

Stephanie M. Lawley  
Stephanie M. Lawley, Reg. No. 55362  
LEYDIG, VOIT & MAYER  
700 Thirteenth Street, N.W., Suite 300  
Washington, DC 20005-3960  
(202) 737-6770 (telephone)  
(202) 737-6776 (facsimile)

Date: Jul. 24, 2009

Amendment or ROA - Regular (SML/mlg)

Exhibit A

26. 10. 1999

CLAIMS

(75)

1. A method for treatment of aqueous nitrate-containing liquids streams comprising the steps of:
  - (a) acidifying the nitrate-containing liquid, thereby forming a nitrate-containing solution wherein the pH is maintained at less than 5;
  - (b) contacting the solution thus formed with at least one metal, whereby the nitrate contained therein is converted to nitrite; and
  - (c) contacting the resulting nitrite-containing solution with at least one amide, whereby the nitrite is reacted to form nitrogen.
2. A method as claimed in claim 1, characterised in that said steps of acidifying the nitrate-containing liquid, contacting the resulting solution with at least one metal, and contacting the nitrite-containing solution with at least one amide are carried out simultaneously in the same reactor vessel.
3. A method as claimed in claim 1 or 2, characterised in that the at least one metal is selected from cadmium, zinc, lead, iron, silver, copper, mercury, tin, nickel, manganese, magnesium, and alloys or mixtures thereof.
4. A method as claimed in claim 1, 2 or 3, characterised in that the at least one amide is selected from urea, sulfamic acid, formamide, acetamide, and mixtures thereof.
5. A method as claimed in any preceding claim, characterised in that metal ions formed by said step of contacting the nitrate-containing solution with at least one metal are electrochemically recovered in metallic form.
6. A method as claimed in any preceding claim, characterised in that said aqueous nitrate-containing liquids include slurries.

**Bescheid/Protokoll (Anlage)****Communication/Minutes (Annex)****Notification/Procès-verbal (Annexe)**Datum  
Date  
Date 17.06.2002Blatt  
Sheet  
Feuille 1Anmelde-Nr.:  
Application No.:  
Demande n°: 98 915 297.0

## Exhibit B

The examination is being carried out on the following application documents:

Text for the Contracting States:

AT BE CH LI DE DK ES FI FR GB GR IE IT NL SE

**Description, pages:**

1-20 as originally filed

**Claims, No.:**

1-6 as received on 26.10.1999 with letter of 22.10.1999

**Drawings, sheets:**

3 as originally filed

The following document D1 is referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1: JP 53 067678 and related Derwent abstract AN 1978-54014[A]

A Copy of the above Derwent abstract is appended to the communication.

The amended claims filed with the letter dated 22.10.1999 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 123(2) EPC. The amendment is the following.

The beginning of claim 1 reads: A method for treatment of aqueous nitrate containing liquid streams comprising the steps of:

(a) Acidifying the nitrate-containing liquid, thereby forming a nitrate containing solution wherein the pH is maintained at less than 5;



**Bescheid/Protokoll (Anlage)**

Datum  
Date  
Date 17.06.2002

**Communication/Minutes (Annex)**

Blatt  
Sheet  
Feuille 2

**Notification/Procès-verbal (Annexe)**

Anmelde-Nr.:  
Application No.: 98 915 297.0  
Demande n°:

From the description It is neither evident where this limit value of pH 5 is to be found nor from where it can be deduced.

Claim 1 contains thus added subject matter and is not allowable under article 123(2) EPC.

- If the added subject-matter is disregarded, the remaining subject-matter of claim 1 is known from D1 as this document clearly states an operating pH range between 5,5 and 7,5 (page 341, left column, 4 lines from bottom, Derwent abstract).

Clear delimitation over D1 would be made possible by specifying organic amide in claim 1 since D1 uses sulfamic acid and ammonium sulfamate, (page 343 left column lines 8-9 from top) which is an inorganic amide.

The applicant is requested to file new claims which take account of the above comments and to consequently adapt the description; in this respect, all references to inorganic amides in general, and sulfamic acid or salts should be removed, D1 should be mentioned in the description (Rule 27(1)(b) EPC).

Following receipt of suitably amended application documents, the grant of a patent is foreseen.

## EXAMPLE V

## Exhibit C

[0072] For this example, several electrolytic tests were performed to demonstrate operability a further step of the invention.

5 [0073] Solutions were prepared by dissolving either  $\text{CdSO}_4$ ,  $\text{Cd}(\text{NO}_3)_2$  or  $\text{CdCl}_2$  in the de-ionized water. The initial pH was adjusted to about pH = 2 with the appropriate mineral acid.

[0074] The electroreductive stripping of cadmium from aqueous solution was carried out in a RETEC<sup>TM</sup> cell. The 12 L of solution containing 13 g of  $\text{Cd}^{2+}$  per L was electrolyzed for 5-8 hours. The solution was never heated or cooled except for the ohmic heating.

10 [0075] During the electrolysis, the pH tended to decrease and was held at a pH of 2 by the addition of 5.0 M NaOH. Several combinations of cathode materials (nickel and aluminum sheets) and polarizers (polyacrylamide, bone glue and gelatin) were used. The polarizers were necessary to inhibit the reduction of water to hydrogen gas, thereby increasing the overall current efficiency of the process.

[0076] The best results were obtained with aluminum cathodes and 60 mg/l of polyacrylamide. The average current efficiency was 88% at the 13 - 2 g/L range, and 46% at the 2 - 0.2 g/L range. The cadmium concentrations in the solutions decreased to 0.05 ppm. The cadmium deposit on the cathode was soft and easily removable from the aluminum surface. Current efficiencies and final  $\text{Cd}^{2+}$  concentrations were independent of the counter-ion.

[0077] Cadmium recovered in these runs was used in Example 1 for nitrate reduction.

20 [0078] While the compositions and processes of this invention have been described in detail for the purpose of illustration, the inventive compositions and processes are not to be construed as limited thereby.

## INDUSTRIAL APPLICABILITY

25 [0079] The invention can be used for processing nitrate streams from nuclear, industrial (e.g., fertilizer manufacturing), mining and farming operations and in environmental restoration projects. The invention can be used for upgrading the capabilities of existing wastewater treatment plants.

## Claims

30

1. A method for treatment of aqueous nitrate-containing liquids streams comprising the steps of:

- 35 (a) acidifying the nitrate-containing liquid;  
(b) contacting the solution thus formed with at least one metal, whereby the nitrate contained therein is converted to nitrite; and  
(c) contacting the resulting nitrite-containing solution with at least one organic amide, whereby the nitrite is reacted to form nitrogen.

40 2. A method as claimed in claim 1, **characterised in that** said steps of acidifying the nitrate-containing liquid, contacting the resulting solution with at least one metal, and contacting the nitrite-containing solution with at least one organic amide are carried out simultaneously in the same reactor vessel.

45 3. A method as claimed in claim 1 or 2, **characterised in that** the at least one metal is selected from cadmium, zinc, lead, iron, silver, copper, mercury, tin, nickel, manganese, magnesium, and alloys or mixtures thereof.

4. A method as claimed in claim 1, 2 or 3, **characterised in that** the at least one organic amide is selected from urea, formamide, acetamide, and mixtures thereof.

50 5. A method as claimed in any preceding claim, **characterised in that** metal ions formed by said step of contacting the nitrate-containing solution with at least one metal are electrochemically recovered in metallic form.

55 6. A method as claimed in any preceding claim, **characterised in that** said aqueous nitrate-containing liquids include slurries.

## Patentansprüche

1. Ein Verfahren zur Behandlung von wässrigen nitrathaltigen Flüssigkeitsströmen, umfassend folgende Schritte: